

**Specification for
Single Phase Smart Prepayment Energy Meter with
Communication Module**



7.1 Scope

Single Phase: This technical specification covers the design, manufacture, testing and supply of single-phase whole current AC 5(60) Amps Smart Pre-payment Energy Meter of accuracy Class 1.0.

The smart Pre-payment Meter should have plug & play type BPLC AND GPRS communication module. The meter should be able to connect point to point communication with head end system (HES).

The Smart Pre-payment features like online recharge, tariff and charge configuration, emergency credit/friendly hour configuration, daily and monthly billing data collection, on demand read etc. to be implemented through HES.

The meter must be able to detect and record power off & power on, tamper, load control, configuration, tariff setting, firmware update and payment related event with date and time stamp. Meter can push the related event to HES when the event occurs, such low credit alarm, no credit disconnection, emergency in use or friendly in use, tamper. Utility and customer can receive the related SMS notification as per the configuration.

7.2 Scope of Supply

The tenderer shall be responsible for supply of Energy Meter with related services packing, loading, shipment, custom clearance if necessary, and transportation, insurance and unloading at site. The supplied meters will be operated by existing purchasers' software (API attached in appendix). Interfacing of the offered meter is the responsibility of the tenderer.

Item No.	Name of Goods or Related Services	Description	Unit of Measurement	Quantity
1.	Single Phase Solid State Smart Pre-payment meter with plug & play type BPLC communication module	Single phase, 230 Volt, 5(60)A	Nos.	50913

7.3 Service conditions

The meters to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions. Meters should be capable of maintaining required accuracy under hot, tropical and dusty climatic conditions.

Sl.No.	Condition	Specification
1	Maximum ambient temperature (°C)	50
2	Minimum ambient temperature (°C)	5
3	Maximum daily average temperature (°C)	35
4	Maximum annual average temperature (°C)	30
5	Mean annual rainfall (mm)	2500
6	Minimum annual rainfall (mm)	1461
7	Maximum annual rainfall (mm)	4127
8	Maximum relative humidity (%)	100
9	Average relative humidity (%)	80
10	Maximum wind velocity (km/h)	180
11	Maximum altitude above mean sea level (meters)	200



7.4 Standards and codes of practice

All material and equipment supplied and all works carried out shall comply in every respect with the technical codes of the International Organization for Standardization (ISO) and with the recommendations of the International Electrotechnical Commission (IEC), which apply to the electrical equipment.

Goods and special guarantees beyond the scope of ISO and IEC shall conform at least to one of the following standards and codes.

IEC 62052-11	Electricity metering equipment (AC)- General requirements, tests and test Conditions- Part 11: Metering equipment
IEC 62055	Part 21: Framework for standardization Part 31: Particular Requirements-Static payment meters for active energy (classes 1)
IEC 62053-21, IEC 62053-23	Alternating current static watt-hour meters (classes 1)
IEC 62052-21, IEC 62054-21	Time switches for tariff and load control
IEC 62056-21	Data exchange for meter reading, tariff and load control and direct local data exchange
IEC 1038	The switches for tariff and load control
IEC 1107	Data exchange for meter reading, tariff and load control and direct local data exchange
IEC 58	Shock and vibration, humidity, solar radiation and salt mist etc.
ISO 9001	Code of practice for quality systems part 1: Model for quality assurance in design/development, production, installation and servicing.
IEC 62054	Real Time Clock (RTC)
Others	All other relevant IEC specifications for metering equipment.

7.5 Supply System

Description	Single Phase
Rated voltage (Vref.)	230 V – Phase to Neutral
Rated Current	Basic Current 5 Amps (Ib), Maximum Current 60 Amps (Imax)
Rated Frequency	50 Hz

7.6 Specific Technical Requirements

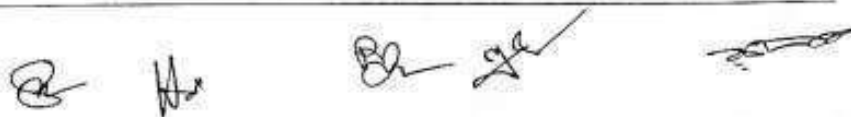
The meters to be supplied against this specification shall meet the requirements specified in this clause.



7.6.1 Electrical requirements

Meter supplied shall meet the following electrical requirements.

Sl.No	Description	Specification
A	Phase	Single Phase
1	Connection	1-Phase, 2-Wire, direct connected (unidirectional, programmable to bi-directional in case of Net Metering)
2	Number of element	02 (two)
3	Rated voltage	230 V phase to neutral.
4	Rated Current: a) Base current, I_b b) Maximum continuous current, I_{max}	≤ 5 A ≥ 60 A; Moreover the 5-60 Amps meter shall work accurately up to 120 % of I_{max}
5	Starting current	20 mA (0.4% I_b)
6	Power consumption in the voltage circuit	≤ 2 Watts and 5 VA
7	Limit of Current	Shall be Programmable within the range of 0.02A to 60 A
8	Continuous over voltage	Should withstand 400 volts for 48 hours without causing any damage or degrading of its operating life, or causing changes of more than 0.01 kWh in its credit registers (excluding the possible decrement of credit due to power being consumed).
9	Variation in voltage	+30% to -30%; The meter shall be suitable for working satisfactorily within the specified range.
10	Rated frequency	50 Hz
11	Variation in frequency	$\pm 2\%$
12	Power factor	The Meter shall be suitable for working satisfactorily from 0.5 lag – unity – 0.8 lead
13	Class index	1.0; The accuracy shall not drift with time.
14	Keypad	12-key, International Standard layout including "information" and "backspace" keys
15	Clock	Built-in real time clock with 10 years battery backup
16	a) Display	LCD; Visibility should be sufficient to read the meter mounted at height of 0.5 to 2.0 m. Pin type; trans-reflective HTN or STN type industrial grade; temperature range -20°C to +70°C
	b) Period of display	Continuous
	c) Digits	WxH: 6 mm x 10 mm (minimum)
	d) Maximum viewing angle	160 degrees
	e) Number of display digits	6+2
17	Harmonic energy	Meter shall record total energy including harmonic energy



Sl.No	Description	Specification
18	Memory	Non-volatile memory that retains information up to 10 years in the absence of power. Described in section 7.7 & 7.16.6.3 The data stored in memory chip can be read by a tool when the meter is broken after demonstration.
19	Power limiting	Meter shall disconnect the load when a pre-programmed threshold power is reached. The threshold shall be programmable in steps of 500W or less.
20	Tamper detection	Sensor to detect any kind of tamper
21	Load disconnection	Latching relay
22	Audible alarm	Buzzer
23	Lightning Protection	In accordance to IEC 62053-21 or latest version of IEC
24	Communication	plug & play type BPLC AND GPRS communication module
25	Application Protocol	DLMS/COSEM and IDIS
26	Installation of Communication Module	Adding or exchanging the communication module should be done without turning off the meter. Meter must be compatible with multi communication module. Utility can replace any module in the same meter if required.
27	Maximum pulse frequency	Shall not exceed 2.5 kHz
28	Sealing Condition	Hermetically Sealed / Fully Ultrasonic Welded.

7.6.2 Mechanical requirements

The enclosure shall be tamper-resistant and shall be suitable for outdoor mounting. The meter shall be such that the internal components in the active part of the meter shall be protected against unintentional damage or tamper during handling and installation.

Furthermore, Meter supplied shall meet the following mechanical requirements:

Sl. No.	Description	Specification
1	Meter Case	The meter shall be constructed by employing flame retardant and high impact strength material. The base, body and frame including terminal block shall be of heat resistive; shock proof and rust proof good quality hard material e.g. unbreakable engineering or stamped metal or molded phenol resin which shall be capable of withstanding of 145° C. The base will be provided with 3 (three) screw mounting holes, 1 (one) slotted meter support bracket at the top and 1 (one) round hole on each side in the bottom half of the base for securely mounting the meter to the meter board. The meter cover shall be of molded transparent Poly-Carbonate. The meter cover shall be provided with a window of transparent Poly-Carbonate or toughened glass. The display shall be of LCD. The base cover should be transparent. The meter shall be effectively sealed to prevent entrance of moisture, rain and dust into its internal parts.

Sl. No.	Description	Specification
2	Terminal	a) Terminal block shall be polycarbonate grade 500R or equivalent bakelite; brass or copper current terminals; two flat-head brass screws at each terminal; b) Terminal cover should be transparent and have provision for sealing. c) Terminal cover should have provision for Side entry connection. d) Minimum free space between bottom of terminal and terminal cover are 60 mm e) For Single Phase: Minimum 4 terminals to accommodate 10 mm ² duplex; terminal cover shall be extended type; terminal bore diameter 6 mm;
3	Connections diagrams and terminal marking	Every meter shall be indelibly marked with a diagram of connection. Meter terminals shall be marked; this marking shall appear on the diagram. Stickers of any kind shall not be accepted.
4	Insulation level	Shall withstand a power frequency test of 4kV and impulse withstand test of 6 kV
5	Protection against penetration of dust and water	Conform to the degree of protection of IP54 or better
6	Top cover sealing	Hermetically sealed/ Fully ultrasonic welded.
7	Pulse output	The meter shall be provided with flashing red LED to represent the pulse output for testing the meter by suitable testing equipment. The operation indicator must be visible from the front.
8	Protection against magnetic field	The Meter Accuracy shall not be affected by AC/DC magnetic field from all sides of the meter i.e., front, sides, top and bottom of the meter. Meter shall not be affected by permanent magnet of 0.5 mT.
9	Temperature range	Limit range of operation: -25°C to 55°C Limit range of storage and transport: -25°C to 70°C
10	Name plate	Every meter shall have clearly visible, effectively secured against removal and indelibly and distinctly marked. The following information's marked on name plate: Manufacturer's name and year of manufacture, Meter type Number of phases and number of wire Meter serial number Rated voltage Basic current and maximum current Reference frequency in hertz Meter constant in imp/kWh & imp/kVarh Class index of the meter Over-current breaking capacity (in kA) UTILITY logo (when supply) Contract No. (When supply)

Sl. No.	Description	Specification
		Reference Standard
11	Optical Port & RS485 port	Meter should have standard optical port for local read and configuration, Meter should have two wired active RS485 port for remote communication.

7.6.3 Latching relay specifications

The latching relay shall be compatible with the offered meter and the operating principle shall be as per requirement. Technical specification of the relay shall be engraved or marked on the body of the relay.

The specification for the latching relay is as follows:

Sl. No	Description	Requirements
		Single Phase
1	Manufacturers Name & Country of origin	To be mentioned
2	Country of Manufacturing	To be mentioned
3	No. of coils	2 (two)
4	Rated coil voltage	12 VDC
5	Rated coil power	6 W
6	Pulse to set	30 ms
7	Contact Material	Silver alloy
8	Maximum Switching Power	15000 VA
9	Maximum Switching Voltage	250 V AC
10	Maximum Switching Current (rms)	60A
11	Contact resistance	$\leq 2 \text{ m}\Omega$
12	Electrical Cycle	1×10^4
13	Mechanical Cycle	1×10^5
14	Insulation resistance	$\geq 1000 \text{ M}\Omega$
15	Dielectric Strength between contacts	$\geq 2000 \text{ VAC}$
16	Dielectric Strength between contact and coil (50 Hz)	$\geq 3000 \text{ VAC}$
17	Dielectric Strength between contacts assembly	$\geq 4000 \text{ VAC}$
18	Ambient temperature	$-40^\circ\text{C} \sim +55^\circ\text{C}$
19	Operating humidity	40 to 90%
20	Temperature rise at rated current (assuming 30°C room temp.)	60°C

7.7 MEASURED & STORED PARAMETERS:

i) Parameters to be Measured

Sl. No	Description	Requirements
		Single Phase
1	Instantaneous:	Voltage (V); Current (I);

Sl. No	Description	Requirements
		Single Phase
		Cumulative-Active Energy Kwh ; Current Demand(kW); Power factor.
2	Billing parameters The billing parameters shall be retained in the meter for at least 12(Twelve) months.	Previous month's MD in kW and Cumulative-Active Energy Kwh; Consumption Active Energy (Kwh) in current month; Remaining balance; Money recharge and used in current month;
3	Time of Use	-Peak, Off-Peak & Super Off-Peak

ii) Power Quality information

Logging of quality of supply events like power on/off, over/under voltage, over current (minimum 100 events). Setting of Under/Over Voltage and over current shall be configurable.

iii) Maximum Demand

Should have Maximum Demand registers kW with integration period of 30 minutes. Resets should be auto monthly or through communication command from HES / HHU.

iv) Load Survey Storage

Meter shall record load survey of minimum 365 days for average voltage, average current, average PF, for all phases, kWh reading and kvarh reading, kVAh reading, average demand in kW with integration period of 30 minutes. It shall be possible to select either demand or energy view at the system end.

v) Tamper/Event recording

A total of last 100 events considering all tampers defined must be detected and logged as tamper events on first in first out basis along with date & time. Meter shall log following Tampers/Events – Over voltage, Low voltage, Over current, Magnet tamper, Neutral missing, Top cover open, Terminal cover open etc.

7.8 Data display facility (manual/auto):

All the above parameters shall be displayed for minimum 10 seconds (configurable) including LCD check & all parameters are configurable. Data Display shall have following modes

a) Auto Scroll: All the following parameters shall be available in auto scrolling mode with OBIS Code:

- Date (DD.MM.YY) & Time (HH.MM.SS)
- Meter Serial Number
- Balance Amount (Tk.)
- Cumulative Forwarded Active Energy (Kwh)
- Current month Active MD
- Instantaneous voltage (V)
- Instantaneous phase current (A)
- Instantaneous Neutral current (A)



- Instantaneous Active power (KW)
- Last Recharge Date & Time
- The current Tariff

b) **Scroll with Push-button:** It shall be possible to display the following parameters in sequence through push-button provided on the meter with OBIS Code:

- LCD All Segment Display
- Date (DD:MM:YY) & Time (HH-MM:SS)
- Meter Serial Number
- Balance Amount (Tk.)
- Cumulative Forwarded Active Energy (Kwh)
- Instantaneous voltage (V)
- Instantaneous phase current (A)
- Instantaneous Neutral current(A)
- Instantaneous Active power (KW)
- Current Month Forwarded Active MD
- Cumulative Forwarded Active Energy of Last Bill
- Forwarded Active MD of Last Month
- Date & Time of Last Month MD
- Balance Amount (Tk.)
- Last Recharge Date & Time
- Error Code for communication problem diagnosis
- Latest Sequence number of token.

7.9 Tamper detection

- A tamper sensor shall be provided to detect that terminal cover has been opened both in power supply and without power supply.
- Tamper shall be detected with and without power supply. When the meter detects a tamper condition, it should enter a shutdown state, with an appropriate message. The customer should be disconnected immediately.
- Meter should not power up /work in missing neutral connection (relay should open).
- Removal of battery shall be considered as a tamper.

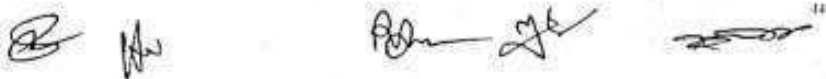
In case of Magnetic effect, Neutral disturbance, Terminal cover open and any other tamper detection, relays should get disconnected immediately which can be reconnected through HES or through token. Meter must be capable of detecting multiple tampers.

The tamper status shall be reset by using a uniquely coded tamper reset token that may only be used once.

The meter should be able to count energy in any type of connection as long as the credit remains. Whenever the credit is zero, the relay should trip except for emergency or friendly hour. Otherwise, the tender will be rejected.

7.10 Indication on display:

- Status of Relay-indication of status of relay i.e. Connected/Disconnected should be available on display.
- Power Supply Status: visible indication of the status of the incoming supply i.e. Power supply On/Off.



- c) Low Credit indication.
- d) Credit Status.
- e) Voltage indication.
- f) Tamper Indication
- g) Network Status

7.11 Display Unit/LCD:

- a) The measured value(s), status, alarm, event information etc. Should be displayed on a Liquid Crystal display (LCD) register.
- b) The display should have backlit capability for easy reading.
- c) An illuminated display with a minimum lifetime of ten years is required.
- d) The size (number of rows and characters per row) should be appropriate for the display and interpretation of the messages and meter information, and should be legible from a distance of at least 500 cm with a viewing angle no less than 30°.

7.12 Memory/Data Retention:

The data should be stored in non-volatile memory (NVM). The non-volatile memory should retain data for a period of not less than 10 years under un-powered condition. The memory should record billing history and load profile data for last one year.

7.13 Optical Interface

The meter shall have an IEC 62056-21 compliant optical communication port. This should allow the utility to access via front for variety of customer information stored inside the meter and to upload it into a hand-held unit (HHU).

7.14 Electromagnetic compatibility

(a) Immunity to electromagnetic disturbance

The meter shall be designed in such a way that conducted or radiated electromagnetic disturbances as well as electrostatic discharge do not damage or substantially influence the meter. The disturbances to be considered are:

- i. Electrostatic discharges
- ii. Electromagnetic HF field
- iii. Fast transient burst

(b) Radio interference suppression

The meters shall not generate conducted or radiated noise which could interfere with other equipment.

7.15 Accuracy requirements

(a) Limits of error due to variation of the current

The percentage errors shall not exceed the limits for the relevant accuracy class stipulated in IEC standard.

(b) Limits of error due to other influence quantities

The additional percentage error due to the change of influence quantities shall not exceed the limit for the reference accuracy class stipulated in IEC standard.

(c) Limits of error due to ambient temperature variation

The limits of error shall not exceed the limits stipulated in IEC standard.

(d) Starting and running with no-load

Initial start-up of the meter: The meter shall be fully functional within 5 seconds after the voltage is applied to the meter terminals.

Running with no load: When the voltage is applied with no current flowing in the current circuit the test output of the meter shall not produce more than one pulse.

Starting: The meter shall start and continue to register at a) Single Phase: 0.41% at power factor of 1;

(e) Meter constant

The relation between the test output and the indication in the display shall comply with the marking on the name-plate.

7.16 Functional Requirement

7.16.1 Security

All credit and meter management tokens shall be meter specifically encrypted to guarantee security of the system. Encrypted tokens shall not be reusable. Tokens to display status and test the meter may be un-encrypted and reusable.

7.16.2 Token validation

If a token not meant for the meter is applied, the meter should display a message to that effect. Similarly, if a valid token is re-entered into the meter, then the meter must display an appropriate message.

7.16.3 Meter personalization

In addition to factory personalization and personalization via encrypted tokens, it shall be possible to personalize the meter from a hand-held unit (HHU) provided the HHU is authorized/ programmed to communicate with the meter.

7.16.4 Meter modes

The meter shall be required to support at least three modes of operation, namely the prepayment mode, post payment mode and the meter test mode.

7.16.5 Prepayment mode

The basis of this mode is that credit is transferred to the meter, and provided the meter remains in credit, the meter provides supply. The credit register is decremented against current consumption with the countdown total being displayed on the meter display.

7.16.6 Meter Post paid mode

The meter should support Post paid mode that is activated either from a dedicated token or using HHU. This mode allows meter to work as AMI smart meters to keep online and calculate the consumption and payment in billing system as required.



7.16.7 Meter test mode

The meter should support a test mode that is activated either from a dedicated test token, or using the HHU. This test should be automated in the meter and should include a full diagnostic test, testing of the all the active and inactive functionality, metering accuracy test (1 minute load test), and connection validation tests. Meter test mode shall also display following information:

- i) Meters software version
- ii) Current limit
- iii) Switch open and close count
- iv) Token acceptance & rejection count

7.16.8 Energy accounting

7.16.8.1 Credit register

The credit register is the "operating account" of the meter being decremented by the metering process. The specific requirements of this register are:

- a) This register must be decremented for the equivalent of every credit unit consumed.
- b) When the available credit has been consumed, the meter must open the contactor and isolate supply from the customer (unless the Friendly hours or Emergency Credit option is invoked).
- c) This register can become negative only from use of emergency credit/friendly hour.

7.16.8.2 Consumption during current billing period

- a) This register records the cumulative energy consumption for the current billing period.
- b) The registers shall be updated at least every 10 Wh.

7.16.8.3 Historic consumption

For this option there are six energy registers that store the total energy consumed for the previous six months.

- a) These registers are cycled at during the month-end process, with the oldest data being deleted.

7.16.8.4 Cumulative energy consumption

- a) This register records the cumulative consumption since the meter was commissioned.
- b) The units of storage are kWh, rounded to two decimal points (10 Wh).

7.16.8.5 Billing

Billing operates on a monthly basis. Energy consumption charge is deducted within the meter for at least every 10 Wh. All other charges including demand charge, meter rent, vat etc are deducted as per prevailing rules of Bangladesh Energy Regulatory Commission (BERC) at the POS.

7.16.8.6 Month-end calculation

At the end of each month, the meter should perform a month-end calculation that consists of the following minimum steps:

- a) The cumulative monthly energy registers must be reset, and the historic registers must be updated.
- b) The meter must determine whether a new tariff will become active, and if so, must delete the old tariff.

7.16.8.7 Date and time management

a) The meter shall be equipped with a real time clock supporting the date and time as per IEC standard. Pseudo-clock using mains crossing detection is not acceptable. The maximum drift of the clock shall be less than 30 seconds per month. The battery and/or auxiliary power source shall operate maintenance free for a period of at least 10 years.

b) The meter must be equipped with a battery monitoring system that monitors the battery's condition and initiates a "Change Battery Alarm" to the point of sale when the battery approaches the end of its operating life. If the battery is not replaced, the failure of the battery is deemed to constitute a meter failure, and the meter should be shut down.

c) Date and time may be changed using meter parameterization software.

7.16.9 Tariff Management

7.16.9.1 Tariff

All tariff calculation must be done within the meter.

The meter is required to support stepped tariffs structures as well as time-of-use and maximum demand.

The tariff structure consists of the following records:

- i) Each tariff must be uniquely identified using the tariff code
- ii) Each tariff shall have an activation date, being the date on which the tariff becomes effective.
- iii) Each tariff has up to seven steps (in kWh) for different levels of energy pricing.
- iv) The rate describes the cost per kWh for energy consumption in that step.

7.16.9.2 Tariff management in the meter

- a) Tariffs shall be entered into the meter via the two-way token or HHU. The meter should not allow tariffs to be manually entered using meter parameterization software.
 - When the meter is active with a tariff, the current tariff cannot be overwritten bypassing the token/MDM.
 - The meter must record time and date stamp when the tariff is loaded into meter.
- b) In general, when a tariff has expired in the meter, the tariff is automatically deleted by the meter.

7.16.9.3 Tariff security and verification

The meter shall write the active tariff code to the token on each insertion.

7.16.9.4 Tariff switchover

When the meter detects that a new tariff is applicable (using the tariff activation date), the meter should execute the following steps:

- i) The meter shall begin the billing against the new tariff from the current slab.
- ii) The current tariff code shall be updated to reflect the new tariff code.
- iii) The old (expired) tariff should be deleted.
- iv) New tariffs will only be activated at 00:00 on the first day of a month.

7.17 Status/Event displays

In addition to the displays required above the meter must display the following minimum information in an intuitive way such that an inexperienced user can understand and interpret the information intelligibly. Laminated instruction cards are to be provided for each unit.

- i) Meter ID.
- ii) Out of Credit message
- iii) Invalid token entered
- iv) Duplicate token entered
- v) Meter tamper state
- vi) Meter failure and/or fault code

7.18 Friendly:

The meter shall accommodate the "Friendly hours" features. These are time periods during which the meter shall not cut-off power to consumer if the credit becomes negative. Meter should not be on until full negative amount is paid back. Insufficient (not more than negative balance) recharge token will be accepted by meter and update the current balance. But the meter will be disconnected. Details of the features are described in the following table. All options should be allowed for one time in each vending.

Sl. No.	Requirement	Description
1	Friendly hours	There shall be provision to define 'Friendly hours' in the meter. The utility shall be able to define the 'Friendly hours' and shall be communicated to the meter through token.

7.19 Emergency credit:

Provision shall be made in the meter for an Emergency Credit facility that allows the customer to draw on an emergency credit should the credit in the register be consumed.

The specific requirements of this facility are:

- a) When the credit register value reaches a programmable Emergency Credit Threshold the meter should sound an audible alarm, and prompt the user to accept the use of the Emergency Credit facility (card insertion or button depression). The meter should not supply energy against emergency credit unless acknowledged by the customer.
- b) If all the available credit in the credit register is expired and power disconnected, the facility to activate the Emergency Credit should remain an option to the user.



- c) The meter should remain in service until the Emergency Credit Limit has been reached and not recharged an amount more than current outstanding, after which the supply should be disconnected.
- d) If the Emergency credit limit is set to zero, the Emergency Credit Threshold shall function as a low credit warning and provide the user with a visual and audible alarm that credit is low. The user shall have the option to silence the alarm by inserting a card or pressing a button to accept the alarm.
- e) If emergency credit has been previously consumed, then the value of emergency credit used shall be deducted from the next token inserted into the meter. Meter should not be on until full loan amount is paid back.
- f) Once emergency credit has been exhausted, no further credit facilities shall be available until the full emergency credit allocation has been paid for.
- g) In case of negative credit status, meter should not accept balance clear token.

7.20 Load Control

Meters shall have the options to control loads with the following features:

- a) There shall be provision in the meter to define the allowable loads for given time periods within a day.
- b) There shall be provision in the meter to accommodate the date of activation of the defined load allocation.
- c) Load limit shall be defined in step of 500 W.
- d) Single phase Smart meter shall be equipped with integrated/ separate load control switches (latching relay) at both phase and neutral to control flow of electricity to the load at the instance of connect/ disconnect commands as per functional need of the system. Both Load switches (latching relay) shall operate simultaneously for connect/ disconnect purpose and shall be mounted inside the meter with suitable arrangement.
- e) The meter should be able to count energy in any type of connection as long as the credit remains. Whenever the credit is zero, the relay should trip except for emergency or friendly hour. Otherwise, the tender will be rejected.
- f) The rating of switches used shall be as per IEC.

7.21 Load Disconnection/Reconnection:

- a) The load shall be disconnected by a latching relay under the following conditions:
 - i) The credit in the meter has expired and grace facilities also expired.
 - ii) The load power threshold has been exceeded.
 - iii) The meter is in a tampered state.
 - iv) Neutral missing at source side.
- b) The meter shall indicate whether the load is connected or not and shall display the reason for disconnection.
- c) The customer shall not have the option to switch the contactor manually. Under over – current conditions the mechanism to automatically reconnect the load must ensure that the number of switching cycles is limited. The meter shall attempt to reconnect the load up to 5



times at 30-second intervals. If the over-current condition still exists the meter shall wait a period of 30 minutes before attempting to reconnect the load.

- d) After the load is disconnected by a latching relay, all the circuits should remain disconnected even if the phase and neutral connections are shifted to each other
- e) After load is disconnected by a latching relay, all circuits should remain disconnected and there will be no possibility of being circuited through a local earth either in phase or in neutral terminal as partially or fully.

7.22 Smart Pre-Payment Features

7.22.1 Balance calculation:

Balance calculation will be implemented at pre-payment meter as per energy consumption. HES will collect the billing data on a scheduled basis.

7.22.2 Friendly Hours:

Friendly Hours list shall be configurable on meter & during this period no disconnection shall be done.

The utility shall be able to define the **Friendly Hours** and shall be communicated to the meter through HES. The meter shall accommodate the **"Friendly Hours"** features. These are time periods during which the meter shall not cut-off power to consumer if the credit becomes negative.

7.22.3 Emergency credit:

Provision shall be made in the meter for an Emergency Credit facility that allows the customer to draw on an emergency basis should be recorded in the register. Emergency Credit facility shall be configurable on HES & during this period no disconnection shall be done from HES side.

7.22.4 Load Control

Meter shall support relay connection/disconnection in following conditions:

- Over Current
- Load control limit (Load Control limits shall be remotely programmable).
- Disconnect signal from Utility Control Centre

7.22.5 Load Disconnection/Reconnection:

i) Load disconnection –

- a) If meter credit is exhausted, then meter should disconnect immediately. At any reason if authority wants to disconnect the load of the meter, Disconnection shall be done from HES.
- b) On defined tamper/event condition meter will disconnect the load.

ii) Load Reconnection-

- a) Reconnection mechanism under disconnection from utility control center. Reconnection shall normally be done from HES.

7.22.6 Low Credit indication & alarm:

When balance is less than defined value in meter, the meter could trigger one alarm and push to HES.

7.22.7 E- Recharge /Vending -

- a) The Vending system shall be available for online recharge as well as physical recharge. After online recharge, meter should get credited immediately and automatically.
- b) Customer should receive SMS/email notification like low credit, zero balance, negative balance, recharge successful, recharge failed, Emergency in use, friendly in use, load disconnect.

7.23 Meter identification cards

- a) In case of keypad meters, for each meter shall be supplied with a meter identification card, which complies with NRS 009-4: 1995.
- b) The printed details and graphic design of the cards shall be submitted prior to producing the cards.

7.24 Testing and approval

- a) It will be the responsibility of the tenderer to submit to the Employers representative for approval a complete Acceptance Test Procedure (ATP) for system verification.
- b) Once the Employer's representatives approve the ATP, the testing and performance validation tests on 2% (random samples) of the supplied meters will commence. The Employer's representative at the utility's premises will witness these tests.

7.25 Quality assurance

Tenderers shall comply with and be certified to the following ISO levels:

ISO 9001 Quality systems

Model for quality assurance in design development production installation and servicing

Model for quality assurance in final inspection and test

Tenderers shall submit copies of certification with their proposal to this effect.

7.26 Keypad Numbering Scheme

The meter number scheme will be the unique and be followed by a convention of all the utilities. The number scheme will not be the scheme described but the description will be the basic of the convention of the meter number scheme which will be supplied after signing of the contract.

While the manufacturer is free to use any number scheme they see fit, the number scheme must be secure and use minimum number of digits and must always contain the following fields in encrypted form:

Meter ID

Recharged amount

Sanctioned Load

Sequence Number

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The meter must check the validity of these fields before recharging the credit. The sequence number is an auto generated number starting from 1 for each recharge or keypad numbers. A keypad number will only be accepted if the previous number has been keyed in. For example, if a consumer goes to POS to recharge 300Tk and gets key code xxxxyyzzz (which contains sequence number n). The next month he goes again to recharge 250Tk and gets key code pppqqrrr (which contains sequence number n+1). Key code pppqqrrr will only be accepted if xxxxyyzzz has been keyed in previously i.e. meter will only accept a key code containing sequence number 'n' if at some point key code containing sequence number 'n-1' has been keyed in. This is to ensure that key codes are not discarded by a consumer intentionally.

Periodically it may be necessary to generate a key code that contains more data. The key code scheme must be able to accommodate the following data if and when required:

Meter ID

Recharged amount

Sanctioned Load

Sequence Number

Load Change

- Sanctioned Load
- Start Time

Rate

- Start Unit
- Peak Rate
- Off peak Rate
- Activation Date

It is assumed that the keypad number with only the meter id, amount, load and sequence number will be a lot shorter than the key code containing all the rate information.

7.27 Meter Connection Procedure

After meter install in the field, it is mandatory to register meter in the vending system. The register operation will make system communicate with meter and confirm the communication ability.

7.28 Meter Numbering

It must be possible to program the meter with 12-digit meter number.

7.29 Tariff Management

7.29.1 Tariff Definition

The System Manager shall be able to define tariff objects. Each tariff has a unique tariff ID associated with it. The following information is required to define a tariff.

Tariff ID	A unique tariff identifier
Effective Date	The date on which the tariff will be effective.

Tariff and all charges will be effective as per direction of Bangladesh Energy Regulatory Commission (BERC).

Present Tariff Structure and other charges (for reference)
 LT (Low Tension) : i) Single Phase: 230 Volt, 0-7.5 kW & ii) Three Phase: 400 Volt, 0-50 kW

1. LT-A : Residential		
Step Structure	Step	Energy Rate/Charge (Tk./Kwh)
Life line	0-50 kWh	$R_0 = 4.63$
1st Step	0-75 kWh	$R_1 = 5.26$
2nd Step	76-200 kWh	$R_2 = 7.20$
3rd Step	201-300 kWh	$R_3 = 7.59$
4th Step	301-400 kWh	$R_4 = 8.02$
5th Step	401-600 kWh	$R_5 = 12.67$
6th Step	600+ kWh	$R_6 = 14.61$

Consumer Class	ToU	Energy Rate/Charge (Tk./Kwh)
2. LT-B: Agriculture Pump		$R_0 = 5.25$
3. LT-C1: Small Industries	Flat	$R_0 = 10.76$
	Off-peak	$R_1 = 9.68$
	Peak	$R_2 = 12.95$
4. LT-C2: Construction		$R_0 = 15.15$
5. LT-D1: Education, Religious & Charitable and Hospital		$R_0 = 7.55$
6. LT-D2: Street Light, Water Pump		$R_0 = 9.71$
7. LT-D3: Battery Charging Station	Flat	$R_0 = 9.62$
	Off-peak	$R_1 = 8.66$
	Supper Off-peak	$R_2 = 7.68$
	Peak	$R_3 = 12.14$
8. LT-E: Commercial & Office	Flat	$R_0 = 13.01$
	Off-peak	$R_1 = 11.71$
	Peak	$R_2 = 15.62$
9. LT-T: Temporary		$R_0 = 20.17$

Subject	Tariff Category	PFC Calculation
Power Factor Correction (PFC) Charges	LT-A, B, C1, D1 & E' Category, 3-Phase, 400V, 20KW & above	* PF Maintain in 0.95 to 1.00. * Power Factor (PF) obtained from meter.
	LT-C2 & D2 (Only Pump) Category, 3-Phase, 400V	* Monthly average PF less than 0.95 then- From 0.95 to 0.75 for every 0.01 step less surcharge will impose 0.75% of energy bill.







Subject	Tariff Category	Time
Time of Use	LT-C1 & E Category	Peak – 17:00 to 23:00 Off Peak-23:00 to 17:00 Flat-24 hours
	LT-D3 Category	Peak – 17:00 to 23:00 Off Peak-23:00 to 05:00 and 09:00 to 17:00 Super Off Peak-05:00 to 09:00 Flat-24 hours

Meter Rent	A fixed charge is levied per month.
Sanctioned Demand Charges (Fixed Charge)	A fixed charge per kW of the sanctioned demand is levied per month.
Maximum Demand Charges	Integrated over 1/4 hourly periods Maximum Demand in KW.
VAT	Value added tax is levied on electricity charges and must be catered for in the system.

- The tariff code, effective date, kWh_h (in units of kWh), R_v together with a fixed monthly service Charges and a fixed monthly sanctioned demand shall be used to define all Pre-payment tariffs used in the system.
- The MIC shall make provision for up to 500 tariff definitions.
- The MIC must verify the tariff data entered and shall not allow discontinuities in the energy levels or negative rates for energy and fixed charges.
- There shall be a facility to copy tariffs to new tariff codes for editing purposes. The edit facility shall include a mechanism to increase the values of any of the variables R_v, SC and DC by a fixed percentage.
- Tables of Supply Group Codes and tariffs shall be securely stored at the MIC.
- No penalty Charges for Power Factor above 0.95 to 1.0. Power Factor Correction Charge is computed as above and average power factor is measured by meter based on only reactive energy. The monthly average power factor from meter is used for the factor and applied on the monthly consumption.

7.29.2 Tariff Algorithm

The Pre-payment system can implement stepped tariffs. The tariffs will be implemented at the vending equipment/meter. The algorithm must ensure that:

- The Stepped tariffs are implemented in meter as accurately as is the case for conventionally billed customers.
- Customers are not restricted to the amount and frequency of electricity token purchases provided purchases.
- If any tariff changes, the updated tariff will be sent using special numbers for keypad meters. After utility decides the tariff update, all purchase of credit (with keypad number) will carry and tariff change flag. So that the meter will not accept any credit addition until it gets the tariff update.